

WHAT IS CLAIMED IS:

1. A frequency synchronizing method in an OFDM wireless system for synchronizing oscillation frequency of a receiving device to oscillation frequency of a transmitting device, comprising steps of:
 - receiving, from the transmitting device, frames in which symbols having identical time profiles have been embedded;
 - calculating a correlation value between the identical time profile portions in neighboring frames of a receive signal;
 - obtaining the phase of said correlation value as a frequency deviation between the transmitting device and the receiving device; and
 - controlling oscillation frequency based upon said phase.
2. A frequency synchronizing method according to claim 1, further comprising steps of:
 - successively calculating correlation values, in symbol intervals, between a receive signal that prevailed one frame earlier and a currently prevailing receive signal; and
 - adopting a peak correlation value, at which power of the correlation values peak, as said correlation value of said identical time profile portion.
3. A frequency synchronizing method according to claim 2, wherein symbols having said identical time profile are embedded in identical portions of each of the frames.
4. A frequency synchronizing method in an OFDM wireless system for synchronizing oscillation frequency of a receiving device to oscillation frequency of a transmitting device, comprising steps of:
 - receiving, from the transmitting device, frames in which n-number of first to nth symbols having prescribed time profiles have been embedded;
 - calculating and summing correlation values of n sets of corresponding time profile portions in neighboring frames of a receive signal;
 - obtaining the phase of said sum value as a frequency deviation between the transmitting device and the receiving device; and
 - controlling oscillation frequency based upon said phase.
5. A frequency synchronizing method according to claim

4, wherein said n-number of first to nth symbols are embedded in identical portions of each of the frames.

6. A frequency synchronizing method according to claim 4, wherein said n-number of first to nth symbols are
5 embedded equidistantly in each of the frames.

7. A frequency synchronizing method according to claim 6, further comprising steps of:

successively calculating correlation values, in symbol intervals, between a receive signal that
10 prevailed one frame earlier and a currently prevailing receive signal; and

summing corresponding correlation values at cycles of $1/n$ frame, obtaining a peak correlation value at which power peaks, and adopting this peak sum value as
15 said sum value.

8. A frequency synchronizing method in an OFDM wireless system for synchronizing oscillation frequency of a receiving device to oscillation frequency of a transmitting device, comprising steps of:

20 receiving, from the transmitting device, frames having a plurality of symbols in which a guard interval has been inserted and in which symbols having identical time profiles have been embedded;

calculating a correlation value (a first
25 correlation value) between a time profile in a guard interval and a time profile of a symbol portion that has been copied to a guard interval, obtaining the phase of said first correlation value as a frequency deviation between the transmitting device and the
30 receiving device, and controlling oscillation frequency based upon said phase; and

when a predetermined condition holds, calculating a correlation value (a second correlation value) between identical time profile portions in mutually
35 adjacent frames of a receiving signal, obtaining the phase of said second correlation value as a frequency deviation between the transmitting device and the receiving device, and controlling oscillation frequency based upon said phase.

40 9. A frequency synchronizing method according to claim 8, further comprising steps of:

successively calculating correlation values, over guard-interval widths, between a receive signal that
45 prevailed one symbol earlier and a currently prevailing receive signal, and adopting a correlation value at

which power peaks as said first correlation value; and
successively calculating correlation values, over
symbol-interval widths, between a receive signal that
prevailed one frame earlier and a currently prevailing
5 receive signal, and adopting a correlation value at
which power peaks as said second correlation value.

10. A frequency synchronizing method in an OFDM
wireless system for synchronizing oscillation frequency
of a receiving device to oscillation frequency of a
10 transmitting device, comprising steps of:

receiving, from the transmitting device, frames
having a plurality of symbols in which a guard interval
has been inserted and in which n-number of first to nth
symbols having prescribed time profiles have been
15 embedded;

calculating a correlation value (a first
correlation value) between a time profile in a guard
interval and a time profile of a symbol portion that
has been copied to a guard interval, obtaining the
20 phase of said first correlation value as a frequency
deviation between the transmitting device and the
receiving device, and controlling oscillation frequency
based upon said phase; and

when a predetermined condition holds, calculating
25 and summing correlation values of n sets of
corresponding time profile portions of two neighboring
frames of a receive signal, obtaining the phase of said
sum value as a frequency deviation between the
transmitting device and the receiving device, and
30 controlling oscillation frequency based upon said phase.

11. A frequency synchronizing method according to
claim 10, further comprising steps of:

successively calculating correlation values, over
guard-interval widths, between a receive signal that
35 prevailed one symbol earlier and a currently prevailing
receive signal, and adopting a correlation value at
which power peaks as said first correlation value; and

when n-number of first to nth symbols have been
embedded equidistantly in each of the frames,
40 successively calculating correlation values, over
symbol-interval widths, between a receive signal that
prevailed one symbol earlier and a currently prevailing
receive signal, summing corresponding correlation
values at cycles of $1/n$ frame, obtaining a peak sum
45 value at which power peaks, and adopting this peak sum

value as said sum value.

12. A frequency synchronizing method according to claim 8, wherein said predetermined condition is assumed to hold when said phase has fallen below a set value or when a set period of time has elapsed since start of control.

13. A frequency synchronizing apparatus for synchronizing oscillation frequency of an OFDM receiving device to oscillation frequency of an OFDM transmitting device, comprising:

a receiving unit for receiving frames in which symbols having identical time profiles have been embedded;

a correlation arithmetic unit for calculating a correlation value between the identical time profile portions in neighboring frames of a receive signal;

a phase detector for obtaining the phase of said correlation value as a frequency deviation between the transmitting device and the receiving device; and

an oscillation frequency controller for controlling oscillation frequency based upon said phase.

14. A frequency synchronizing apparatus according to claim 13, wherein said correlation arithmetic unit has:

means for successively calculating correlation values, in symbol intervals, between a receive signal that prevailed one frame earlier and a currently prevailing receive signal; and

means for adopting a peak correlation value, at which correlation power peaks, as said correlation value of said identical time profile portion.

15. A frequency synchronizing apparatus for synchronizing oscillation frequency of an OFDM receiving device to oscillation frequency of an OFDM transmitting device, comprising:

a receiving unit for receiving frames in which n-number of first to nth symbols having prescribed time profiles have been embedded;

a correlation arithmetic unit for calculating and summing correlation values of n sets of corresponding time profile portions in neighboring frames of a receive signal;

a phase detector for obtaining the phase of said sum value as a frequency deviation between the transmitting device and the receiving device; and

an oscillation frequency controller for

controlling oscillation frequency based upon said phase.
16. A frequency synchronizing apparatus according to claim 15, wherein said correlation arithmetic unit has:

5 means for successively calculating correlation values, in symbol intervals, between a receive signal that prevailed one frame earlier and a currently prevailing receive signal in a case where n-number of first to nth symbols have been embedded equidistantly in each of the frames;

10 a summing unit for summing corresponding correlation values at cycles of $1/n$ frame; and means for adopting a sum value at which power peaks as said sum value.

17. A frequency synchronizing apparatus for
15 synchronizing oscillation frequency of an OFDM receiving device to oscillation frequency of an OFDM transmitting device, comprising:

a receiving unit for receiving frames having a plurality of symbols in which a guard interval has been
20 inserted and in which symbols having identical time profiles have been embedded;

first frequency control means for calculating a correlation value (a first correlation value) between a time profile in a guard interval and a time profile of
25 a symbol portion that has been copied to a guard interval, obtaining the phase of said first correlation value as a frequency deviation between the transmitting device and the receiving device, and controlling oscillation frequency based upon said phase;

30 second frequency control means for calculating a correlation value (a second correlation value) between identical time profile portions in mutually adjacent frames of a receiving signal, obtaining the phase of said second correlation value as a frequency deviation
35 between the transmitting device and the receiving device, and controlling oscillation frequency based upon said phase; and

control changeover means for changing over frequency control to the second frequency control means
40 when said phase has fallen below a set value by control performed by the first frequency control means or when a set period of time has elapsed since start of control by the first frequency control means.

18. A frequency synchronizing apparatus according to
45 claim 17, wherein said first frequency control means

successively calculates correlation values, over guard-interval widths, between a receive signal that prevailed one symbol earlier and a currently prevailing receive signal, obtains a correlation value at which power peaks as said first correlation value, and obtains the phase of said first correlation value as a frequency deviation between the transmitting device and the receiving device; and

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said second frequency control means successively calculates correlation values, over symbol-interval widths, between a receive signal that prevailed one frame earlier and a currently prevailing receive signal, obtains a correlation value at which power peaks as said second correlation value, and obtains the phase of said second correlation value as a frequency deviation between the transmitting device and the receiving device.

19. A frequency synchronizing apparatus for synchronizing oscillation frequency of an OFDM receiving device to oscillation frequency of an OFDM transmitting device, comprising:

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a receiving unit for receiving frames having a plurality of symbols in which a guard interval has been inserted and in which n-number of first to nth symbols having prescribed time profiles have been embedded;

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first frequency control means for calculating a correlation value (a first correlation value) between a time profile in a guard interval and a time profile of a symbol portion that has been copied to a guard interval, obtaining the phase of said first correlation value as a frequency deviation between the transmitting device and the receiving device, and controlling oscillation frequency based upon said phase;

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second frequency control means for calculating and summing correlation values of n sets of corresponding time profile portions of two neighboring frames of a receive signal, obtaining the phase of said sum value as a frequency deviation between the transmitting device and the receiving device and controlling oscillation frequency based upon said phase; and

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control changeover means for changing over frequency control to the second frequency control means when said phase has fallen below a set value by control performed by the first frequency control means or when a set period of time has elapsed since start of control

by the first frequency control means.

20. A frequency synchronizing apparatus according to claim 19, wherein said first frequency control means successively calculates correlation values, over guard-
- 5 interval widths, between a receive signal that prevailed one symbol earlier and a currently prevailing receive signal, obtains a correlation value at which power peaks as said first correlation value, and obtains the phase of said first correlation value as a
- 10 frequency deviation between the transmitting device and the receiving device; and
- said second frequency control means successively calculates correlation values, over symbol-interval widths, between a receive signal that prevailed one
- 15 frame earlier and a currently prevailing receive signal in a case where n-number of first to nth symbols have been embedded equidistantly in each of the frames, sums corresponding correlation values at cycles of $1/n$ frame, adopts a peak sum value at which power peaks as said
- 20 sum value and obtains the phase of said peak sum value as a frequency deviation between the transmitting device and the receiving device.